IMPACT ANALYSIS - NEWUA RILDA

CANYON SPRINGS

Prepared for

WEST APPA COAL COMPANY

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Salt Lake City, Utah

March, 1983

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IMPACT ANALYSIS - NEWUA RILDA

CANYON SPRINGS

West Appa Coal Company recently acquired coal lease rights to the Helco Mine property located in Rilda Canyon, Emery County, Utah (See Plate 1). Located on the eastern side of East Mountain in Huntington Canyon, Rilda Canyon has been the site for development of four mines, none of which are currently operating. As required by the State of Utah Division of Oil, Gas, and Mining, prior to development of coal resources in the Rilda Canyon area, environmental issues must be addressed, impacts from mining to the environment projected, and mitigation measures developed. Of primary concern to West Appa Coal Company is the proximity of proposed mining activities in Rilda Canyon to the Rilda Canyon Springs which currently serve as the primary culinary water source to the North Emery Water Users Association (NEWUA), serving some 630 connections.

The scope of this report is to address the source of water to the NEWUA's Rilda Canyon Springs and potential impacts to said springs, and to discuss the status of proposed mitigation measures currently under investigation.

Regional Geologic Setting of Principal Springs in the Huntington Creek Drainage

Of prime importance in understanding the source of waters issuing from the Rilda Springs is an understanding of geology in the area and the interaction of groundwater movement with geologic features. Plate 1 illustrates surficial geologic formations of the Rilda Canyon area and adjacent canyons to the north including Mill Fork Canyon and Little Bear Canyon. As illustrated on Plate 1, approximately seven different geologic types, primarily cretaceous in age, are exposed within the Rilda, Mill Fork and Little Bear drainage basins; the Flagstaff Limestone formation (limestone with minor amounts of sandstone, shale, and volcanic ash), the North Horn formation (variegated shales with sandstone and freshwater limestone), the Price River formation (sandstone interbedded with shale and conglomerate), the Castle Gate Sandstone, the Blackhawk formation (sandstone, shale, and coal), the Star Point Sandstone (deltaic and beach deposits), and the Masuk Shale member of the Mancos Shale (marine in origin). Of importance to West Appa Coal Company are the Hiawatha and Blind Canyon coal seams which lie near the base of the Blackhawk formation.

The predominant faulting pattern consists of north-south trending fault zones. Significant faulting and fracturing have occurred throughout the Wasatch Plateau region. Immediately to the west of Rilda, Mill Fork, and Little Bear canyons lies the

Joes Valley fault zone, the most extensive of the fault zones in the Wasatch Plateau field. To the east and actually traversing Huntington and Rilda Canyon creeks at their confluence lies the Pleasant Valley fault zone. According to Doelling (1972), displacements of as much as 2000 to 2500 feet have occurred in the Joes Valley fault zone, and displacements of as much as 1500 feet have been noted along the Pleasant Valley fault zone.

Although no major faults have been identified to exist within the Rilda Mine permit area, structural changes which have occurred around the mine permit area have resulted in significant fracturing within sandstone zones of the various formations, as evidenced by jointly patterns in exposed sandstone along the northern slope of Rilda Canyon. Also as evidenced by the exposed sandstone in Rilda Canyon, there appears to be no evidence of displacement in the formations within Rilda Canyon, which is further evidence that significant faults do not exist within the mine permit area.

Springs throughout the area appear to be surfacing primarily above and below the Blackhawk formation, with one noteworthy exception which will be subsequently discussed. A survey of springs has been conducted within and adjacent to the Rilda Mine permit area. Plate 1 illustrates the location of all springs (with regard to geologic formation) found during the survey. As noted from Plate 1, with the exception of the "Side Canyon Spring", (a developed NEWUA spring located in Rilda Canyon), all springs either issue from the Price River, North Horn, or Flagstaff formations overlying the Blackhawk formation or from the Starpoint Sandstone which underlies the Blackhawk formation.

Field observation in mines located in the Wasatch Plateau coal field have shown that typically only a limited amount of subsurface water is found in the Blackhawk formation. It has also been found that in general faults in the Blackhawk formation do not yield significant quantities of water since the nature of the Blackhawk material (fine textured) is such that fracture or fault systems have sealed and thus remained relatively impermeable. Noteworthy exceptions to this phenomenon have occurred within mines when a tension crack has formed as a result of folding or buckling in the formation, resulting in a gap which is not so readily sealed.

Although no significant north-south trending faults are known to exist in the Rilda Canyon area west of the Pleasant Valley fault zone, other physical features in the area such as the general orientation of the major springs issuing from the Star Point sandstone in the Rilda, Mill Fork, and Little Bear canyon bottoms, and the delineation and orientation of side canyons to Rilda, Mill Fork, and Little Bear canyons in the vicinity of these significant canyon bottom springs indicate the existence of a north-south trending fault which possibly reduces to simply a fracture zone with no displacement at its southern edge in Rilda

Canyon. As illustrated on Plate 1, major springs issue from the Star Point sandstone in Rilda, Mill Fork, and Little Bear canyons. Another noteworthy feature is the occurrence of significant north-south trending side drainage channels at or somewhat upstream from the location of each spring in each canyon. Such a direct delineation and orientation from canyon to canyon of side drainage channels with the springs is certainly not natural and is probably structurally related to a fault or significant fracture system. Such a faulting system is present in the Star Point sandstone near Little Bear spring as identified by field observations by the U.S. Forest Service and Vaughn Hansen Associates. From an examination of surficial geologic features under a stereoscope, it appears that the fault system can be traced into Mill Fork Canyon as evidenced by a sloughing zone near the mouth and directly in line with the side drainage channel from the south.

To verify the existence or extension of the fault or fracture zone into Rilda Canyon from Mill Fork Canyon, a subsurface geotechnical technique known as Very Low Frequency analysis (VLF) was used. Two transects were run in an east west direction across the Rilda Springs area, one along the northern road which bypasses the springs and one along the road bypassing the springs to the south. In both transects, a significant subsurface anomolous condition was encountered in the vicinity of the springs and directly in line with the north and south side canyons.

Description of NEWUA Springs

A plan view of the NEWUA Rilda Canyon spring collection system is illustrated on Plate 2. As illustrated on Plate 2, at the junction box the system separates into a spring collection system located primarily on the north side of Rilda Creek and a spring collection system located on the south side of Rilda Creek. In addition to the springs located in the canyon bottom, one spring has been developed in the side canyon to the south (referred to as the Side Canyon Spring).

Reference to the spring collection areas has been segregated in accordance with the ability to segregate water quality sampling within the spring area. As noted on Plate 2, there are several spring collection points (perforated pipes) within each of the North and South spring collection areas. However, water quality samples for the North and South spring collection areas can only be obtained from their respective discharge pipes into the junction box. Therefore, water quality samples are composite samples of the various collection points within each spring collection area. Located near piezometer R-4 on the pipe line to the Side Canyon Spring is a valve which directs water from the Side Canyon Spring into a clean out line which discharges into the adjacent drainage channel. This allows segregation of sampling between the Side Canyon Spring and the South Springs collection area.

Quantity

As related by personnel of NEWUA, the principal producing spring in Rilda Canyon is located behind the concrete cutoff wall in the North Springs collection area. In support of the above statement, spring flow data collected from September 14, 1982 to December 7, 1982 indicate that currently from 78 to 85 percent of the total combined flow from NEWUA's Rilda Canyon Springs is derived from the North Spring collection area. It should be noted however, that NEWUA feels that the South Spring collection system has been rendered less effective by the penetration of roots from phreatophytes into the collector zones and NEWUA is anticipating redeveloping the South Springs area in the summer of 1983. Therefore, the above percentage figures will change if redevelopment of the South Springs collection area proves successful.

As evidenced by the location of the principal spring, the positioning of the concrete cutoff wall, and the positioning of the perforated pipe collection system behind the cutoff wall, the source of water for the principal spring is from the north. The principal spring is directly in line with the north south trending fracture zone identified by the VLF analysis. Therefore, the primary source of water for the Rilda Springs area is from the north via the fractured zone of the Star Point sandstone.

The seasonal distribution of the monthly average flow from all NEWUA'S Rilda Canyon Springs is compared with the seasonal distribution of stream flow of Huntington Creek in Figure 1. Since daily flow records are not maintained on Rilda Springs, it is difficult to estimate the exact lag time between the time when surface streamflow of Huntington Creek is at its peak and when the flow from Rilda Springs is at its peak. However, a comparison of the bar graph and curve illustrated on Figure 1 shows a rapid response of springflow to surface streamflow conditions, probably less than 15 days. As indicated previously, it is felt that all three major springs in Little Bear, Mill Fork, and Rilda canyons are supplied by the same fault and/or fracture system. Such rapid response by the springs to snowmelt runoff conditions would tend to indicate that the fracture system at some point to the north ties into and receives direct recharge from surface streamflow, possibly from Huntington Creek.

Piezometric Contour of Rilda Springs Area

As an aid in determining groundwater characteristics in the vicinity of Rilda Springs, five piezometers (referred to as R-1 through R-5) were installed within and surrounding the springs area (see Plate 2). From these five piezometers, the direction of groundwater movement and the spatial variation of groundwater quality in the springs area have been defined. Illustrated on Plate 3 is the piezometric contour (lines of equal groundwater table elevation) of the Rilda Springs area as determined from data obtained on October 15, 1982. As illustrated on Plate 3, the general direction of groundwater movement (as determined by drawing the flow path perpendicular to the groundwater contour

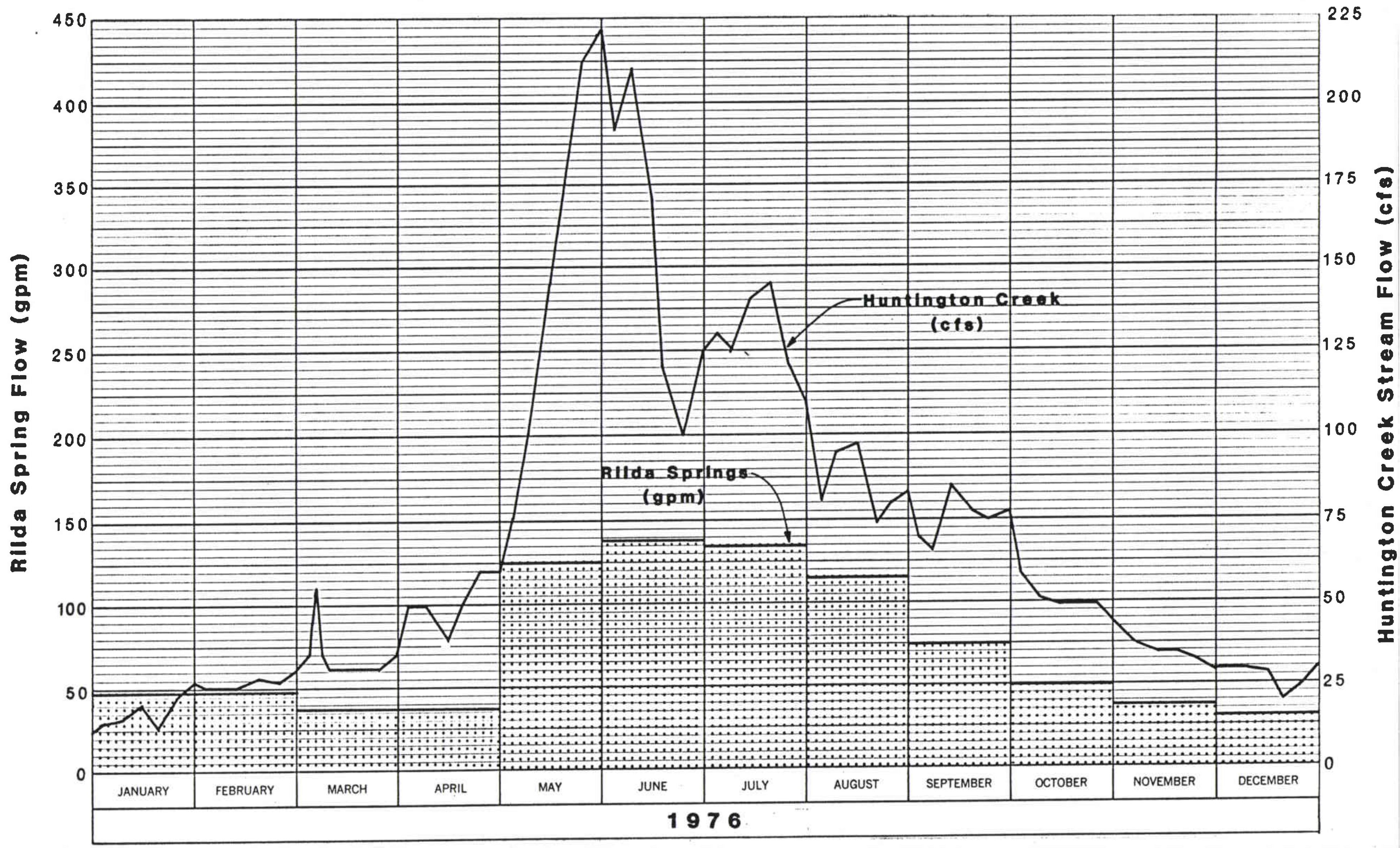

Figure 1. A Comparison of Rilda Canyon Spring flow to Huntington Creek Flow.

lines) is to the east or down the canyon with flow generally from the mountains converging towards the creek bottom.

From the piezometric contour map several significant points become apparent with regard to Rilda Creek in the vicinity of the springs. In general, one would expect groundwater to be flowing toward and recharging creek flows along its entire reach. However, above the spring area the stream is actually loosing water to the groundwater system as evidenced by the fact that the water surface elevation at piezometer R-3 is some 11 feet below the streambed at its nearest point. This phenomenon is due either to the existence of a fracture zone beneath the creek or a significant highly permeable gravel bed beneath the creek which is able to drain inflowing waters from either the creek or groundwater system fast enough to prevent complete saturation of the overlying alluvial deposits. In this situation it is felt that the later possibility is the case since subsequent VLF work revealed no significant anomalous subsurface conditions parallel to the stream and since a coarse water bearing gravel bed was encountered at a depth of from 35 to 40 feet below ground surface (23 to 28 feet below the stream channel bottom) at piezometer R-3.

As the intersection of the north-south trending fracture system with the Rilda Creek channel is approached, the groundwater surface elevation gradually approaches the stream channel elevation. At the intersection of the fracture system with the stream channel which is the location of the principal producing spring area, the groundwater surface elevation has intersected the stream channel, with the creek receiving water rather than loosing through this reach. Surfacing of the groundwater at this point could be due to one of two possible conditions: 1) The large inflow from the north may be to great for the gravel drain to handle, creating in essence a condition where the "groundwater reservoir" overflows simply because more water has been poured into the system than the system can handle, or 2) A physical disruption in the gravel drain may be present as the result of the fracture system at this location. This physical disruption may create in essence a barrier or dyke to subsurface flow through the gravel bed, forcing the water to surface.

Below the spring area, the stream again loses water to the gravel drain beneath. At piezometer R-1 below the spring area the water surface elevation is some four feet below the nearest stream channel bottom elevation.

Flow within the coarse gravel drain below the stream channel is directly tied into surface stream flow. Between September 24, 1982 and October 15, 1982 the water surface elevation in piezometer R-3 dropped only 0.7 feet with the creek still flowing on October 15. By December 6, 1982 the creek had dried up above the springs and the water level had fallen in piezometer R-3 below the bottom of the piezometer (a fall of at least 7 feet between October 15 and December 6).

Groundwater Quality

Water quality samples were collected from each of the five piezometers and from each of the three spring collection areas illustrated on Plate 2 in order to define quality characteristics and variation of groundwaters within the Rilda Springs area. While still accessible prior to the 1982-1983 winter season, water quality samples were collected from each of the above designated sites on September 16, 1982, October 15, 1982, and December 6, 1982. All quality data obtained to date are contained in Appendix A.

As indexed by the major cations (calcium, magnesium, potassium, and sodium) and anions (bicarbonate, chloride, and sulphate) there appears to be two distinct classes of groundwater (primarily defined by sulphate concentrations) within the Rilda Springs area. Illustrated on Figures 2, 3, and 4 are the percent reacting values for major cations and anions for the five piezometers and three spring collection areas as determined from samples collected on September 16, October 15, and December 6, 1982, respectively. As illustrated on these figures, there are two distinct groupings of data from the various sources with regard to sulphate concentrations and total dissolved solids (TDS) concentrations. In general, the Side Canyon Spring, the south Springs collection zone, and piezometer R-4 contain groundwaters higher in TDS and sulfate concentrations than the North Springs collection zone, piezometer R-2, and piezometer R-5.

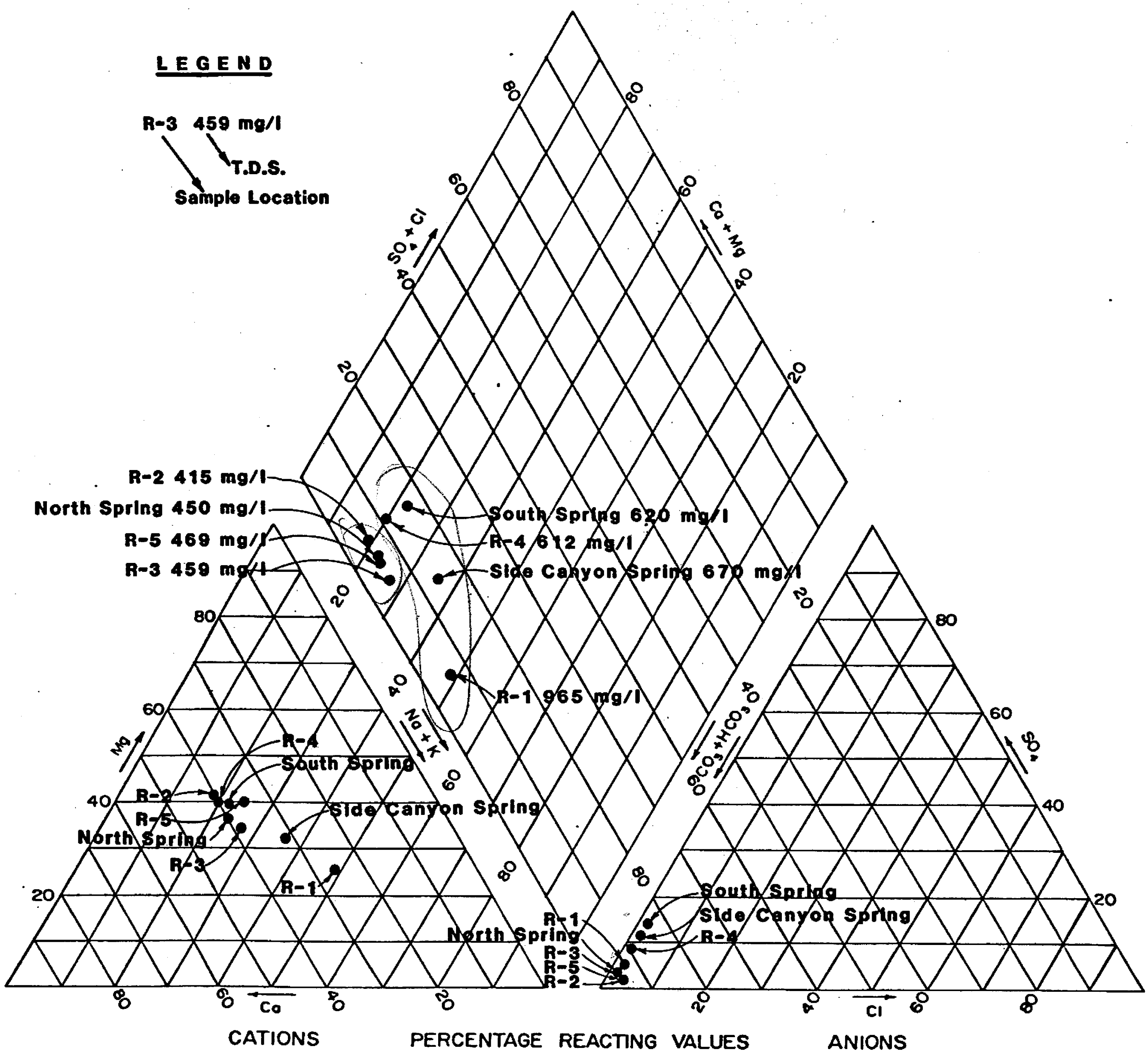

Figure 2. Percent reacting values for cations and anions from groundwater samples obtained in the Rilda Springs area (data obtained on September 16, 1982).

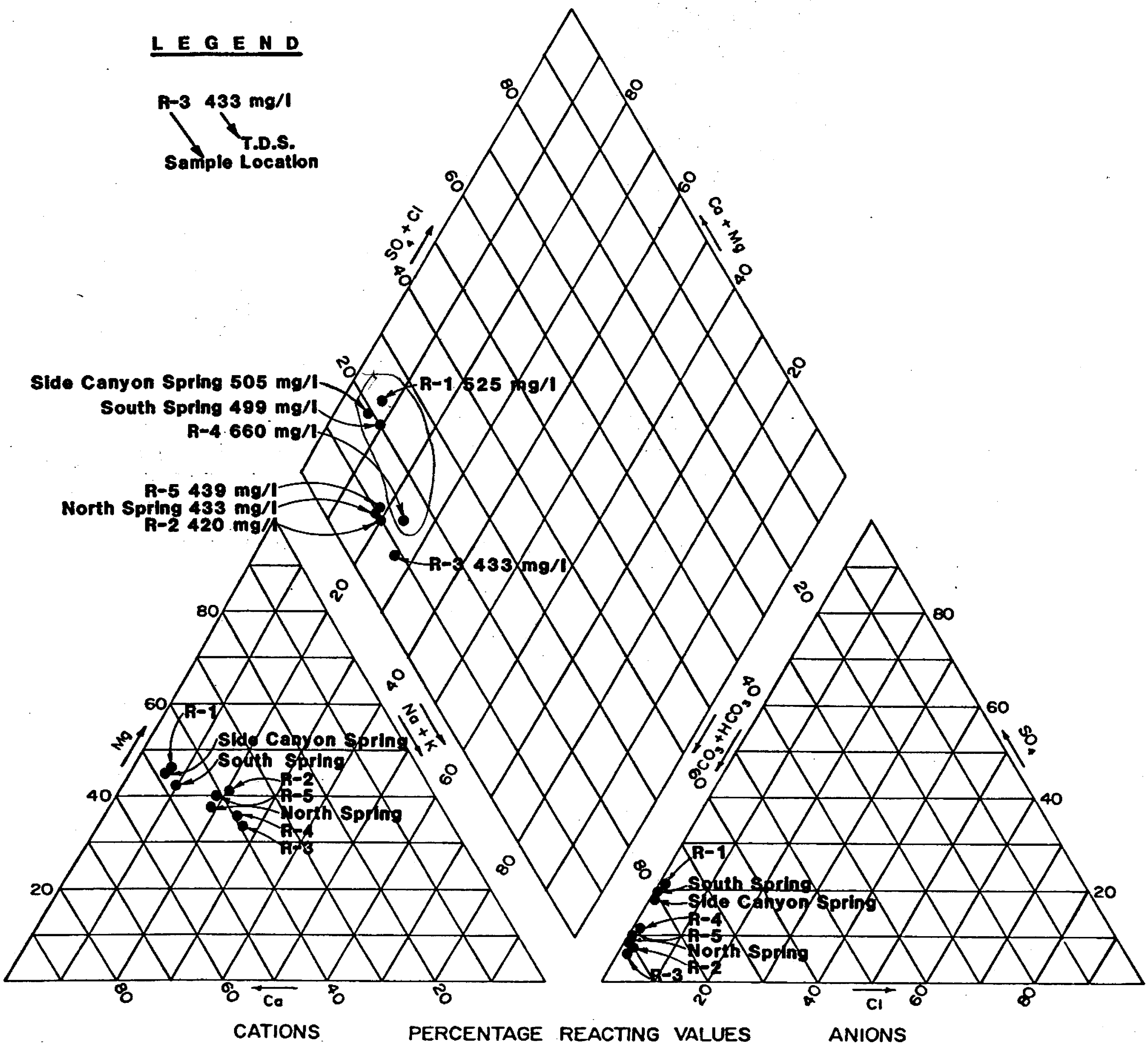

Figure 3. Percent reacting values for cations and anions from groundwater samples obtained in the Rilda Springs area (data obtained on October 15, 1982).

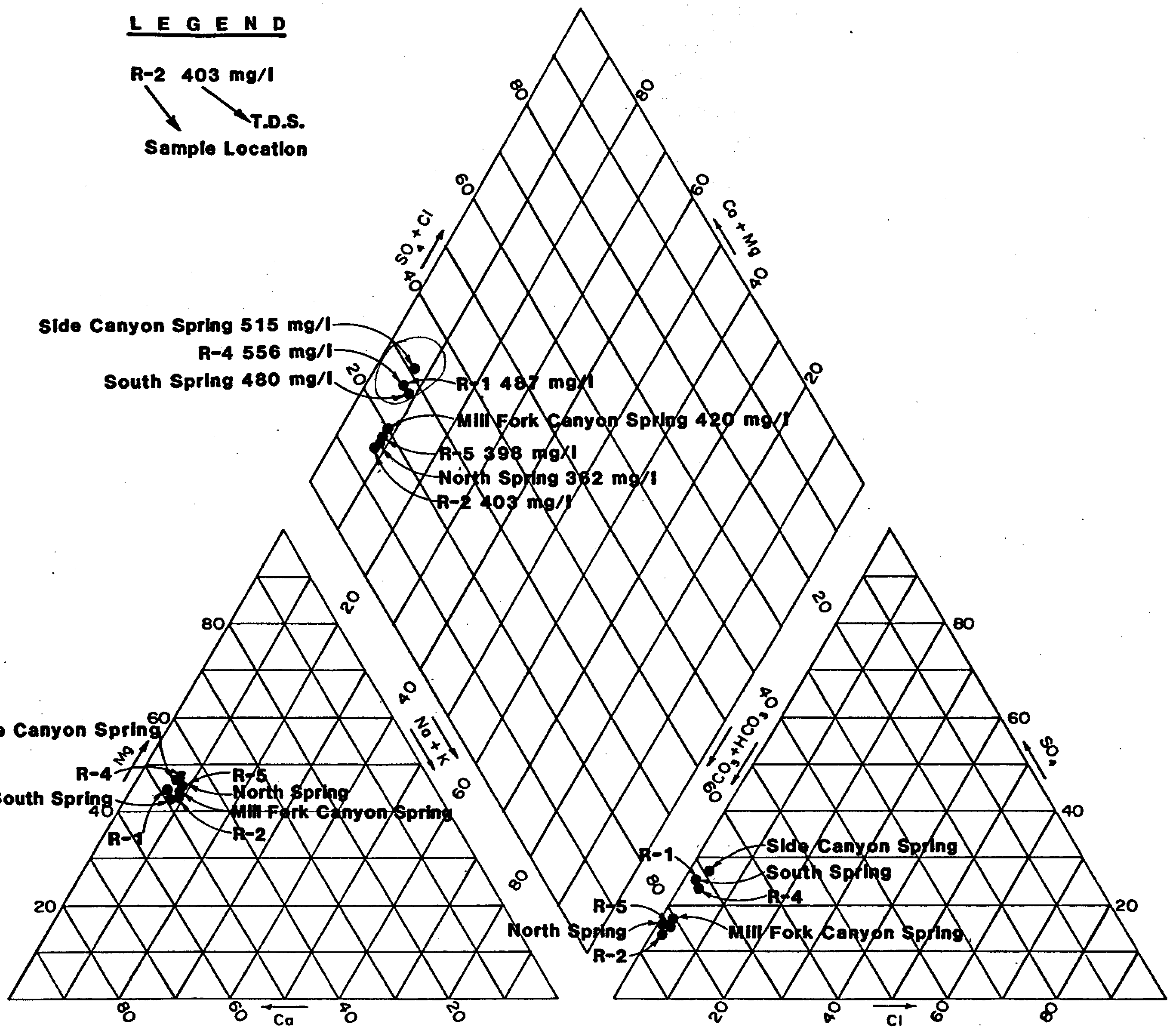

Figure 4. Percent reacting values for cations and anions from groundwater samples obtained in the Rilda Springs area (data obtained on December 6, 1982).

Differences in the above referenced groupings of data reflect differences in the groundwater source or the origin of groundwater for the various springs issuing within the Rilda Springs area. The Side Canyon Spring is located at or near the base of the Blackhawk formation. The higher sulfate concentrations and TDS concentrations from this spring are characteristic of waters associated with the Blackhawk formation due to the presence of shales within the formation from which higher sulfate and TDS concentrations are derived. The similarity in water quality between the Side Canyon Spring and the South Springs collection area would indicate that South Springs waters are also primarily of Blackhawk origin. The slightly better quality of South Springs water over the Side Canyon Spring water indicates that some of the South spring water is derived from waters moving within the fracture zone of the Star Point Sandstone.

As illustrated by TDS concentrations on Figures 2, 3, and 4, waters issuing from the North Springs collection area are of a better water quality than waters from the Side Canyon and South Springs collection areas. As discussed previously, waters issuing from the North Springs originate primarily from water moving within the fracture systems of the Star Point Sandstone and are not derived from the Blackhawk formation.

Impact Projections to the NEWUA Rilda Canyon Springs

As indicated on Plate 1, the proposed Rilda Mine will be located on the south side of Rilda Canyon. Therefore, excluding disturbance from surface facilities, any impact to the Rilda Springs due to coal extraction from the Blackhawk formation will occur from the south. Entries to the mine will be near the old Helco Mine portal located approximately 500 feet northeast and at approximately the same elevation as the Side Canyon Spring.

Based on water quality and piezometric contour data previously discussed, only the South Springs area and Side Canyon Spring are recharged from the Blackhawk formation to the south. These springs currently provide approximately 20 percent of the total flow from the NEWUA developed springs in Rilda Canyon. As indicated previously, this figure may change if NEWUA pursues plans to redevelop the South Springs collection area.

As coal beds to the south are removed and drainage patterns within the Blackhawk formation altered due to mining, recharge from the south to the Side Canyon Spring will be essentially eliminated, thereby eliminating the spring, and recharge to the South Springs collection area will be greatly reduced.

Additional impact to the South Springs collection area will result from proposed surface facilities associated with the mine, which will be located near the canyon bottom immediately south of the mine portal area. As currently proposed, the mine access road will be located on top of the South Springs collection area. Drainage facilities will be installed in the South Springs area to dewater the zone beneath the road to insure a stable foundation. Water from the subsurface drains will be discharged back into the creek.

As long as required surface protection zones are maintained around the North Springs collection area, no impacts are anticipated to the North Springs. Required spring protection zones are presented in the "Utah Public Drinking Water Regulations" and will be discussed subsequently in this report. As discussed previously, recharge to the North Springs collection area is primarily from the north through the north-south trending fracture system. Water from the North Springs is of a different quality than the South Springs or Side Canyon Spring, indicating a different origin for the water than the Blackhawk formation which will be disturbed by mining to the south. Therefore, mining within the Blackhawk formation beneath the southern ridge of Rilda Canyon should have no impact on the quantity or quality of the North Springs. Mine surface facilities could impact the North Springs if the aforementioned spring protection zone is not maintained.

Mitigation and Protective Measures for the NEWUA Rilda Canyon Springs

Protection Zones for the North Springs

West Appa Coal Company has committed to take every precaution to ensure that required protection zones around the North Springs collection area are maintained. As established by the State of Utah Department of Health, the protection zone around a spring is defined in Section 6.3.4 of the State of Utah Public Drinking Water Regulations as follows:

> All land at elevations equal to or higher than, and within 1,500 horizontal feet of, the spring source must be protected against the establishment of concentrated sources of pollution.
>
> All land at an elevation lower than, and within 100 horizontal feet of, the spring must also be so protected. The elevation datum to be used is the point of water collection.
>
> To insure that such protection is available, the water supplier must either
>
> 1. own the protection zone and agree not to locate or permit concentrated sources of pollution within it, or
> 2. if the water supplier does not own the land in question, he must achieve a land use agreement with the owner(s) of the land by which the land owner agrees not to locate or permit concentrated sources of pollution within the protection zone.

The Department of Health does make allowance for specially constructed sewers within the spring protection zone in Section 6.3.4.1 of the aforementioned regulations as follows:

As described above, no concentrated sources of pollution can be permitted within spring protection zones. However, if certain precautions are taken, sewer lines may be permitted at the discretion of the Executive Secretary.

If unavoidable, specially constructed sewer (see Section 6.2.3.4) may be permitted no less than 300 feet from a spring on all lands equal to, or above, the spring elevation. On lands below the spring elevation, these facilities may be permitted to no less than thirty feet from the spring.

All concentrated sources of pollution associated with the mine surface facilites (such as drain fields, septic tanks, chemical and gasoline storage facilities, etc.) will be located at elevations lower than and at a distance in excess of 100 feet from North Springs collection area. Although the proposed administration building and change house (located south of the North Springs) sits at a higher elevation than the springs and portions of the building lie within the 300 foot protection radius for sewer lines outlined above, the building will be designed such that the sewer line exits the building at a point which is outside of the 300 foot radius from the North Springs area. At all points at which the sewer line from the building is at a higher elevation than the North Springs the sewer will be specially constructed in accordance with Department of Health regulations.

Mitigation Plan for Springs

Impacted by Mining

As mitigation for the NEWUA springs that will be impacted by mining, an investigation is underway to determine the potential for developing a well into alluvial deposits located at the confluence of alluvial outwash from Bear Creek Canyon with alluvium of Huntington Creek (See Figure 5). The proposed location has been discussed with officials from the State Department of Health to determine what objections they might have with regard to a well, developed at the proposed site, serving as a community water supply. As indicated by Larry Mize of the State Department of Health, their primary concern with the proposed location is the proximity of the well to Huntington Creek (300-400 feet) and the potential of the well becoming contaminated from this surface water source. Larry Mize indicated that without additional data due to the proximity of the well to the creek the Department of Health would classify the well as an "infiltration gallery" which under current regulations requires full water quality treatment rather than just chlorination. However, Larry Mize also indicated that the Department of Health has not concluded that the well cannot serve as a community water supply without complete treatment. In order to protect the community, the Department of Health must be convinced with additional data that Huntington Creek cannot degrade the quality of the well. Such additional data should include the following information:

1. Grade distribution of alluvial materials at the proposed well site. Such information would be compared with grade distributions of materials considered to be good sand filter type materials for water treatment processes. Said comparison will be made in order to assess the filtration or treatment capacity of the alluvium.

2. Aquifer test data in order to compute travel time from the river to the well.

3. Possibly some die test information.

4. At least one year worth of water quality data from the well.

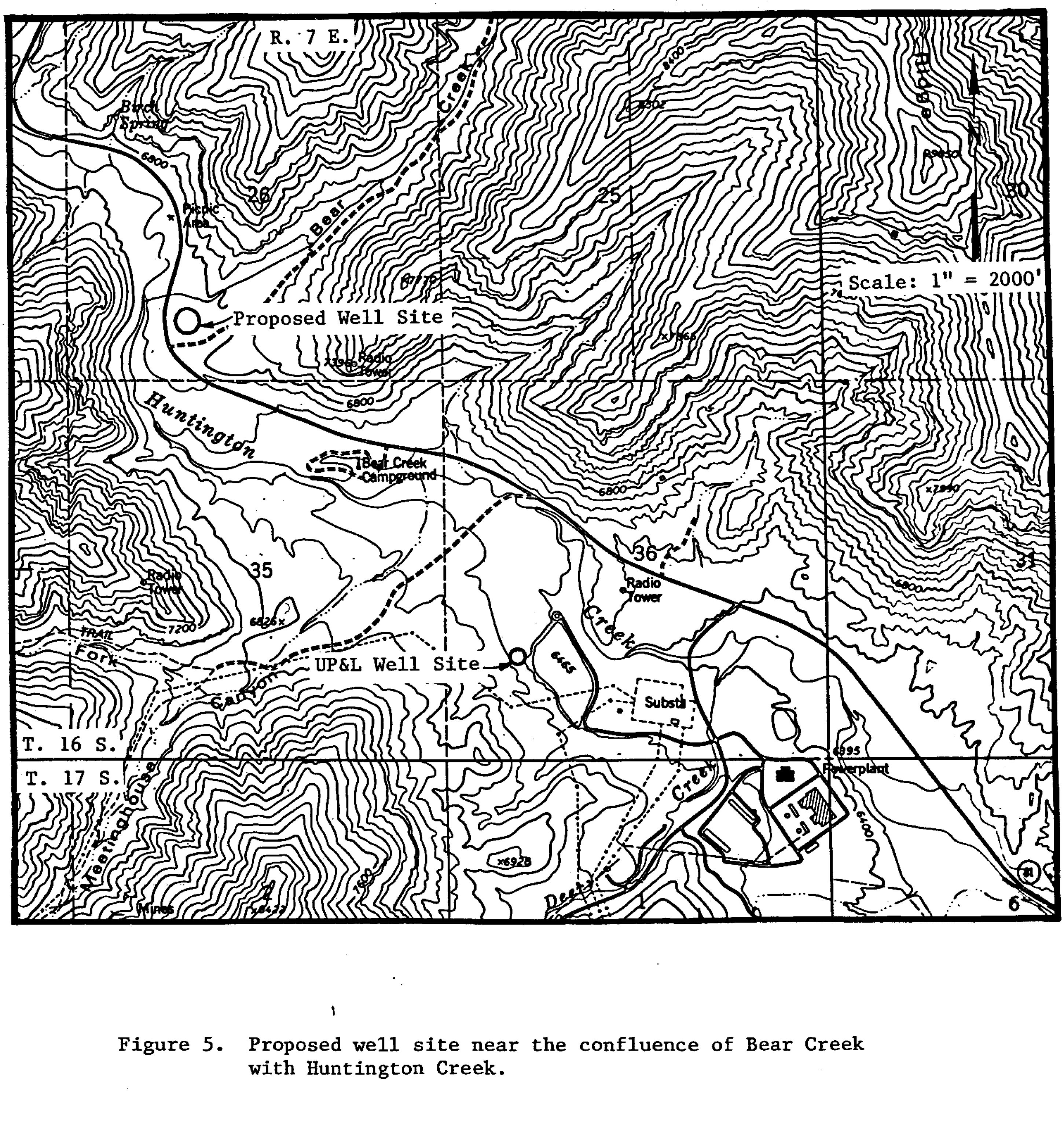

Figure 5. Proposed well site near the confluence of Bear Creek with Huntington Creek.

Without the above information the State Department of Health cannot make a more explicit determination on the well.

In addition to the above information, West Appa Coal Company must be able to demonstrate to the State Department of Health that required protection zones around the well can be secured. As defined in Section 6.2.3.2 of the State of Utah Public Drinking Water Regulations, shallow wells must be isolated from concentrated sources of pollution as follows:

a. On all lands equal to or above the operating water level in the well, the protection zone must extend at least 1,500 feet from the well head.

b. On all lands below the operating water level in the well the protection zone must extend at least 100 feet beyond (i.e. downhill) the intersection of the operating water level elevation with the ground surface, or 1,500 feet whichever is less.

c. Where necessary to protect the quality of the well water the Executive Secretary may require that certain shallow wells be fenced in a manner similar to fencing required around spring areas.

Concentrated sources of pollution includes such items as septic tank and drain field systems, ordinary sewer lines, garbage dumps, pit privies, hazardous waste disposal sites, corrals, feed lots, etc.

West Appa Coal Company is pursuing agreements with surface land owners within the above defined protection zones for the well in order to ensure protection of the well from concentrated sources of pollution. Agreements have been secured or are in the process of being secured from all land owners within the protection zone with the exception of C.O.P. Coal Development Company which owns the W 1/2 of the SE 1/4 of Section 26, T.16S., R.7E. C.O.P. Coal Company would like to build homes on this property in the Bear Creek Canyon bottom. The proposed home site is located some 1200 to 1300 feet from the proposed well site, 200 to 300 feet short of the required 1,500-foot protection zone. However, a current county zoning ordinance prevents the construction of homes in the Bear Creek Canyon area. Larry Mize of the State Department of Health indicated that the Department of Health will accept the current county zoning ordinance as proof that C.O.P. Coal Company will be unable to impact the well with concentrated sources of pollution from home sites. Should the well be installed under this situation, subsequent attempts by C.O.P. Coal Company to have the county zoning ordinance changed would have to be blocked with legal action. Although the county zoning ordinance prevents the construction of homes at the site, it does not necessarily prevent C.O.P. Coal Company from developing other concentrated sources of pollution at the site, such as a corral. This problem must still be resolved in subsequent negotiations.

West Appa Coal Company will proceed as weather permits to secure required data to prove or disapprove the feasibility of developing a well at the proposed site for culinary water purposes. As soon as practical, a core sample of the alluvium at the proposed site will be obtained and a grain size distribution of the sample analyzed. Results from this analysis will be compared with gradations of sand filters used in water treatment processes. Should these results prove favorable, then a test well will be developed to provide the other data requested by the Department of Health as outlined previously.

A P P E N D I X   A

Water Quality Data

from

Rilda Canyon Springs Area

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

WATER QUALITY DATA

Station R-1
Location

DATE	TIME	FLOW (CFS)	TEMPERATURE AIR (°F)	TEMPERATURE WATER (°C)	pH	COLIFORM TOTAL (MPN)	COLIFORM FECAL (MPN)	FECAL STREP (MPN)	C O D (MG/L)	B O D (MG/L)	TOC (MG/L)	DISSOLVED OXYGEN (MG/L)	OIL & GREASE (MG/L)	PHENOL (MG/L)
9-16-82	12:30		14	10	6.8									
10-15-82	17:25		8	8	7.5	23CC	23.0							
12-6-82	17:28		-10	5	7.1									
1-24-83	Inaccessible													

DATE	NITROGEN: AMMONIA as NH_3-N (MG/L)	NITRATE as NO_3-N (MG/L)	NITRITE as NO_2-N (MG/L)	NITROGEN TOTAL KJELDAHL (MG/L)	NITROGEN ORGANIC (MG/L)	PHOSPHATE: TOTAL as PO_4-P (MG/L)	ORTHO as PO_4-P (MG/L)	SULFATE as SO_4 (MG/L)	HYDROXIDE as OH (MG/L)	SURFACTANT as MBAS (MG/L)	SOLIDS: TSS (MG/L)	TOTAL SETTLEABLE SOLIDS (ML/L)	TDS (MG/L)	TOTAL SOLIDS (MG/L)	TOTAL VOLATILE SOLIDS (MG/L)	SPECIFIC COND (µMHOS/CM)	TURBIDITY (NTU)	CARBONATE ALK as CO_3 (MG/L)	BI-CARBONATE ALK as HCO_3 (MG/L)	TOTAL ALK as $CaCO_3$ (MG/L)	TOTAL HARDNESS as $CaCO_3$ (MG/L)	ALPHA RADIO-ACTIVITY (pCi/L)	BETA RADIO-ACTIVITY (pCi/L)	
9-16-82	0.12	0.48	0.04				0.030	51.0					965			643		<0.01	179.80		278			
10-15-82	0.52	0.10	<0.01				0.020	106					525			934		<0.01	470.36		468			
12-6-82	0.34	<0.01	0.04				0.130	110					487			446		<0.01	410.50		434			
1-24-83																								

DATE	ALUMINUM DISS (MG/L)	ANTIMONY DISS (MG/L)	ARSENIC DISS (MG/L)	BARIUM DISS (MG/L)	BERYLLIUM DISS (MG/L)	BORON DISS (MG/L)	CADMIUM DISS (MG/L)	CALCIUM DISS (MG/L)	CHLORIDE DISS (MG/L)	CHROMIUM HEX as CR (MG/L)	COBALT DISS (MG/L)	COPPER DISS (MG/L)	CYANIDE as Cn (MG/L)	FLUORIDE DISS (MG/L)	GERMANIUM DISS (MG/L)	IRON DISS (MG/L)	IRON TOTAL (MG/L)
9-16-82	0.005		<0.001	0.060		0.011	<0.001	97.60	8.40	<0.001		0.010		0.17		0.022	9.900
10-15-82	<0.001		<0.001	0.070		0.040	<0.001	93.60	4.00	<0.001		0.010		0.13		0.030	33.500
12-6-82	<0.001		<0.001	0.050		0.035	0.002	90.40	11.90	0.009		<0.001		0.15		0.430	1.630
1-24-83																	

DATE	LEAD DISS (MG/L)	MAGNESIUM DISS (MG/L)	MANGANESE DISS (MG/L)	MERCURY DISS (MG/L)	MOLYBDENUM DISS (MG/L)	NICKEL DISS (MG/L)	POTASSIUM DISS (MG/L)	SELENIUM DISS (MG/L)	SILICA as SiO_2 (MG/L)	SILVER DISS (MG/L)	SODIUM DISS (MG/L)	ZINC DISS (MG/L)	VANADIUM DISS (MG/L)	Sulfide (MG/L)	NITRATE + NITRITE (MG/L)	Manganese Total (MG/L)	COMMENTS
9-16-82	<0.001	56.16	0.400	<0.0002	<0.001	0.021	5.80	<0.001			210	0.013		0.27		1.220	
10-15-82	<0.001	56.16	0.450	<0.0002	<0.001	<0.001	3.24	<0.001			16.3	0.015		0.80		1.22[illegible]	
12-6-82	0.002	47.92	0.165	<0.0002	<0.001	<0.001	3.24	<0.001			16.5	0.040		0.27		0.200	
1-24-83																	Snow

1-81

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

WATER QUALITY DATA

Station R-2
Location

DATE	TIME	FLOW (CFS)	TEMPERATURE AIR (°C)	TEMPERATURE WATER (°C)	pH	COLIFORM TOTAL (MPN)	COLIFORM FECAL (MPN)	FECAL STREP (MPN)	C.O.D. (MG/L)	B.O.D. (MG/L)	T.O.C. (MG/L)	DISSOLVED OXYGEN (MG/L)	OIL & GREASE (MG/L)	PHENOL (MG/L)	NITROGEN AMMONIA as NH_3-N (MG/L)	NITROGEN NITRATE as NO_3-N (MG/L)	NITROGEN NITRITE as NO_2-N (MG/L)	NITROGEN TOTAL KJELDAHL (MG/L)	NITROGEN ORGANIC (MG/L)
9-16-82	14:10		18	10	7.6										0.34	1.08	0.02		
10-15-82	16:00		14	9	7.8	11.0	<2.0								0.26	0.06	0.03		
12-6-82	16:40		-5	5	7.1										<0.01	0.05	0.03		
1-24-83	In-Accessable																		

DATE	PHOSPHATE TOTAL as PO_4-P (MG/L)	PHOSPHATE ORTHO as PO_4-P (MG/L)	SULFATE as SO_4 (MG/L)	HYDROXIDE as OH (MG/L)	SURFACTANT as MBAS (MG/L)	SOLIDS TSS (MG/L)	SOLIDS TOTAL SETTLEABLE SOLIDS (ML/L)	SOLIDS T.D.S. (MG/L)	SOLIDS TOTAL SOLIDS (MG/L)	SOLIDS TOTAL VOLATILE SOLIDS (MG/L)	SPECIFIC COND. (µMHOS/CM)	TURBIDITY (NTU)	CARBONATE ALK. CO_3 (MG/L)	BI-CARBONATE ALK as HCO_3 (MG/L)	TOTAL ALK as $CaCO_3$ (MG/L)	TOTAL HARDNESS as $CaCO_3$ (MG/L)	ALPHA RADIO-ACTIVITY (pC/L)	BETA RADIO-ACTIVITY (pC/L)	
9-16-82	-	0.050	12.0					415			610		<0.01	499.10		344			
10-15-82		0.020	36.0					420			595		<0.01	459.90		334			
12-6-82		0.560	45.0					403			251		<0.01	354.20		318			
1-24-83																			

DATE	ALUMINUM DISS (MG/L)	ANTIMONY DISS. (MG/L)	ARSENIC DISS. (MG/L)	BARIUM DISS. (MG/L)	BERYLLIUM DISS. (MG/L)	BORON DISS. (MG/L)	CADMIUM DISS. (MG/L)	CALCIUM DISS. (MG/L)	CHLORIDE DISS. (MG/L)	CHROMIUM HEX as CR (MG/L)	COBALT DISS. (MG/L)	COPPER DISS. (MG/L)	CYANIDE as Cn (MG/L)	FLUORIDE DISS. (MG/L)	GERMANIUM DISS. (MG/L)	IRON DISS. (MG/L)	IRON TOTAL (MG/L)
9-16-82	0.004		<0.001	0.055		0.018	<0.001	67.20	9.60	<0.001		0.020		0.18		0.020	6.270
10-15-82	<0.001		<0.001	0.065		0.040	<0.001	64.00	4.20	<0.001		0.019		0.20		0.010	1.450
12-6-82	<0.001		<0.001	0.065		0.045	<0.001	66.40	6.50	0.009		0.010		0.24		0.220	0.810
1-24-83																	

DATE	LEAD DISS. (MG/L)	MAGNESIUM DISS. (MG/L)	MANGANESE DISS. (MG/L)	MERCURY DISS. (MG/L)	MOLYBDENUM DISS. (MG/L)	NICKEL DISS. (MG/L)	POTASSIUM DISS. (MG/L)	SELENIUM DISS. (MG/L)	SILICA as SiO_2 (MG/L)	SILVER DISS. (MG/L)	SODIUM DISS. (MG/L)	ZINC DISS. (MG/L)	VANADIUM DISS. (MG/L)	Manganese Total (MG/L)	NITRATE + NITRITE (MG/L)	Sulfide	COMMENTS
9-16-82	<0.001	42.24	0.130	<0.0002	<0.001	0.017	7.10	<0.001			34.0	0.010		0.285		4.20	
10-15-82	0.002	41.76	0.150	<0.0002	<0.001	0.010	2.84	<0.001			38.0	0.010		0.290		4.84	
12-6-82	0.004	36.48	0.500	<0.0002	0.010	<0.001	3.15	<0.001			13.0	0.025		0.530		4.53	
1-24-83																	Snow

1-81

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

WATER QUALITY DATA

Station R-3
Location

DATE	TIME	FLOW (CFS)	TEMPERATURE AIR (°C)	TEMPERATURE WATER (°C)	pH	COLIFORM TOTAL (MPN)	COLIFORM FECAL (MPN)	FECAL STREP (MPN)	C.O.D. (MG/L)	B.O.D. (MG/L)	TOC (MG/L)	DISSOLVED OXYGEN (MG/L)	OIL & GREASE (MG/L)	PHENOL (MG/L)
9-16-82	13:21		18	12	7.6									
10-15-82	15:45		12	8	7.8	110	<2.0							
12-6-82	16:20	Dry												
1-24-83	Inaccessible													

DATE	NITROGEN AMMONIA as NH_3-N (MG/L)	NITRATE as NO_3-N (MG/L)	NITRITE as NO_2-N (MG/L)	NITROGEN TOTAL KJELDAHL (MG/L)	NITROGEN ORGANIC (MG/L)	PHOSPHATE TOTAL as PO_4-P (MG/L)	PHOSPHATE ORTHO as PO_4-P (MG/L)	SULFATE as SO_4 (MG/L)	HYDROXIDE as OH (MG/L)	SURFACTANT as MBAS (MG/L)	SOLIDS TSS (MG/L)	TOTAL SETTLEABLE SOLIDS (ML/L)	TDS (MG/L)	TOTAL SOLIDS (MG/L)	TOTAL VOLATILE SOLIDS (MG/L)	SPECIFIC COND (µMHOS/CM)	TURBIDITY (NTU)	CARBONATE ALK as CO_3 (MG/L)	BI-CARBONATE ALK as HCO_3 (MG/L)	TOTAL ALK as $CaCO_3$ (MG/L)	TOTAL HARDNESS as $CaCO_3$ (MG/L)	ALPHA RADIO-ACTIVITY (pCi/L)	BETA RADIO-ACTIVITY (pCi/L)	
9-16-82	0.08	0.57	0.03				0.080	9.0					459			566		<0.01	545.30		340			
10-15-82	0.30	0.14	<0.01				0.120	30.0					433			696		<0.01	485.90		310			
12-6-82																								
1-24-83																								

DATE	ALUMINUM DISS (MG/L)	ANTIMONY DISS (MG/L)	ARSENIC DISS (MG/L)	BARIUM DISS. (MG/L)	BERYLLIUM DISS. (MG/L)	BORON DISS. (MG/L)	CADMIUM DISS. (MG/L)	CALCIUM DISS. (MG/L)	CHLORIDE DISS. (MG/L)	CHROMIUM HEX as CR (MG/L)	COBALT DISS. (MG/L)	COPPER DISS. (MG/L)	CYANIDE as CN (MG/L)	FLUORIDE DISS. (MG/L)	GERMANIUM DISS. (MG/L)	IRON DISS. (MG/L)	IRON TOTAL (MG/L)	LEAD DISS. (MG/L)	MAGNESIUM DISS. (MG/L)
9-16-82	<0.001		<0.001	0.055		0.006	<0.001	71.20	7.70	<0.001		0.020		0.16		0.024	12.000	<0.001	38.88
10-15-82	<0.001		<0.001	0.060		0.030	<0.001	66.40	3.70	0.005		0.021		0.14		0.030	0.760	<0.001	34.56
12-6-82																			
1-24-83																			

DATE	MANGANESE DISS. (MG/L)	MERCURY DISS. (MG/L)	MOLYBDENUM DISS (MG/L)	NICKEL DISS. (MG/L)	POTASSIUM DISS. (MG/L)	SELENIUM DISS. (MG/L)	SILICA as SiO_2 (MG/L)	SILVER DISS. (MG/L)	SODIUM DISS. (MG/L)	ZINC DISS (MG/L)	VANADIUM DISS. (MG/L)	Phosphorus Total	NITRATE - NITRITE (MG/L)	Sulfide	COMMENTS
9-16-82	0.030	<0.0002	<0.001	0.013	5.60	<0.001			53.0	0.020		0.330		0.53	
10-15-82	0.038	<0.0002	<0.001	0.033	1.69	<0.001			55.0	0.018		0.360		<0.01	
12-6-82															
1-24-83															Snow

1-81

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

WATER QUALITY DATA

Station R-4
Location

DATE	TIME	FLOW (CFS)	TEMPERATURE AIR (°C)	TEMPERATURE WATER (°C)	pH	COLIFORM TOTAL (MPN)	COLIFORM FECAL (MPN)	FECAL STREP. (MPN)	C.O.D. (MG/L)	B.O.D. (MG/L)	TOC (MG/L)	DISSOLVED OXYGEN (MG/L)	OIL & GREASE (MG/L)	PHENOL (MG/L)	NITROGEN AMMONIA as NH_3-N (MG/L)	NITROGEN NITRATE as NO_3-N (MG/L)	NITROGEN NITRITE as NO_2-N (MG/L)	NITROGEN TOTAL KJELDAHL (MG/L)	NITROGEN ORGANIC (MG/L)
9-16-92	16:40		15	11	7.6										0.27	0.32	0.02		
10-15-92	16:20		10	8	7.6	490	<2.0								0.27	0.07	0.04		
12-6-92	16:55		-7	5	7.0										0.05	0.05	0.04		
1-24-93	Inaccessible																		

DATE	PHOSPHATE TOTAL as PO_4-P (MG/L)	PHOSPHATE ORTHO as PO_4-P (MG/L)	SULFATE as SO_4 (MG/L)	HYDROXIDE as OH (MG/L)	SURFACTANT as MBAS (MG/L)	SOLIDS TSS (MG/L)	SOLIDS TOTAL SETTLEABLE SOLIDS (ML/L)	SOLIDS TDS (MG/L)	SOLIDS TOTAL SOLIDS (MG/L)	SOLIDS TOTAL VOLATILE SOLIDS (MG/L)	SPECIFIC COND (µMHOS/CM)	TURBIDITY (NTU)	CARBONATE ALK. CO_3 (MG/L)	BI-CARBONATE ALK as HCO_3 (MG/L)	TOTAL ALK. as $CaCO_3$ (MG/L)	TOTAL HARDNESS as $CaCO_3$ (MG/L)	ALPHA RADIO-ACTIVITY (pC/L)	BETA RADIO-ACTIVITY (pC/L)
9-16-92		0.050	48.0					612			909		<0.01	662.50		482		
10-15-92		0.020	75.0					660			943		<0.01	695.60		484		
12-6-92		0.190	117					556			470		<0.01	461.30		484		
1-24-93																		

DATE	ALUMINUM DISS (MG/L)	ANTIMONY DISS. (MG/L)	ARSENIC DISS. (MG/L)	BARIUM DISS. (MG/L)	BERYLLIUM DISS. (MG/L)	BORON DISS. (MG/L)	CADMIUM DISS (MG/L)	CALCIUM DISS. (MG/L)	CHLORIDE DISS. (MG/L)	CHROMIUM HEX as CR (MG/L)	COBALT DISS. (MG/L)	COPPER DISS. (MG/L)	CYANIDE as Cn (MG/L)	FLUORIDE DISS. (MG/L)	GERMANIUM DISS. (MG/L)	IRON DISS. (MG/L)	IRON TOTAL (MG/L)	LEAD DISS (MG/L)
9-16-92	<0.001		<0.001	0.060		0.010	<0.001	96.00	12.20	<0.001		0.010		0.16		0.011	10.600	<0.001
10-15-92	0.190		<0.001	0.785		0.220	<0.001	101.60	3.90	0.002		0.009		0.18		0.230	24500	0.003
12-6-92	0.010		<0.001	0.060		0.050	<0.001	97.80	16.40	0.011		0.010		0.18		0.260	12.400	0.006
1-24-93																		

DATE	MAGNESIUM DISS. (MG/L)	MANGANESE DISS. (MG/L)	MERCURY DISS. (MG/L)	MOLYBDENUM DISS. (MG/L)	NICKEL DISS. (MG/L)	POTASSIUM DISS. (MG/L)	SELENIUM DISS. (MG/L)	SILICA as SiO_2 (MG/L)	SILVER DISS. (MG/L)	SODIUM DISS. (MG/L)	ZINC DISS. (MG/L)	VANADIUM DISS (MG/L)	Phosphorus Total	NITRATE + NITRITE (MG/L)	Sulfide	COMMENTS
9-16-92	58.08	0.070	<0.0002	<0.001	0.022	6.40	<0.001			54.0	0.040		0.250		0.40	
10-15-92	55.20	0.080	<0.0002	<0.001	0.010	2.81	<0.001			77.0	0.037		0.240		<0.01	
12-6-92	60.48	0.050	<0.0002	<0.001	<0.001	4.02	<0.001			18.0	0.060		0.220		<0.01	
1-24-93																Snow

1-81

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

WATER QUALITY DATA

Station R-5
Location

DATE	TIME	FLOW (CFS)	TEMPERATURE AIR (°C)	TEMPERATURE WATER (°C)	pH	COLIFORM TOTAL (MPN)	COLIFORM FECAL (MPN)	FECAL STREP (MPN)	COD (MG/L)	BOD (MG/L)	TOC (MG/L)	DISSOLVED OXYGEN (MG/L)	OIL & GREASE (MG/L)	PHENOL (MG/L)
9-16-82	15:50		14	12	7.4									
10-15-82	17:15		9	9	7.8	2.0	<2.0							
12-6-82	17:15		-9	2	7.3									
1-24-83	Inaccessible													

DATE	NITROGEN AMMONIA as NH_3-N (MG/L)	NITROGEN NITRATE as NO_3-N (MG/L)	NITROGEN NITRITE as NO_2-N (MG/L)	NITROGEN TOTAL KJELDAHL (MG/L)	NITROGEN ORGANIC (MG/L)	PHOSPHATE TOTAL as PO_4-P (MG/L)	PHOSPHATE ORTHO as PO_4-P (MG/L)	SULFATE as SO_4 (MG/L)	HYDROXIDE as OH (MG/L)	SURFACTANT as MBAS (MG/L)
9-16-82	1.13	0.18	0.03				0.050	15.0		
10-15-82	0.29	0.10	0.03				0.020	42.0		
12-6-82	0.04	0.06	0.03				0.100	62.0		
1-24-83										

DATE	SOLIDS TSS (MG/L)	SOLIDS TOTAL SETTLEABLE SOLIDS (ML/L)	SOLIDS TDS (MG/L)	SOLIDS TOTAL SOLIDS (MG/L)	SOLIDS TOTAL VOLATILE SOLIDS (MG/L)	SPECIFIC COND (µMHOS/CM)	TURBIDITY (NTU)	CARBONATE ALK. CO_3 (MG/L)	BI-CARBONATE ALK as HCO_3 (MG/L)	TOTAL ALK as $CaCO_3$ (MG/L)	TOTAL HARDNESS as $CaCO_3$ (MG/L)	ALPHA RADIO-ACTIVITY	BETA RADIO ACTIVITY	
9-16-82			469			716		<0.01	552.30		364			
10-15-82			439			758		<0.01	476.20		358			
12-6-82			398			377		<0.01	392.60		364			
1-24-83														

DATE	ALUMINUM DISS (MG/L)	ANTIMONY DISS. (MG/L)	ARSENIC DISS (MG/L)	BARIUM DISS. (MG/L)	BERYLLIUM DISS. (MG/L)	BORON DISS. (MG/L)	CADMIUM DISS (MG/L)	CALCIUM DISS (MG/L)	CHLORIDE DISS. (MG/L)	CHROMIUM HEX or CR (MG/L)	COBALT DISS. (MG/L)	COPPER DISS. (MG/L)	CYANIDE as CN (MG/L)	FLUORIDE DISS. (MG/L)	GERMANIUM DISS. (MG/L)
9-16-82	0.010		<0.001	0.070		0.012	<0.001	68.90	8.00	<0.001		0.010		0.19	
10-15-82	0.010		<0.001	0.070		0.040	<0.001	72.00	3.80	<0.001		0.012		0.17	
12-6-82	<0.001		<0.001	0.045		0.030	0.002	72.00	6.90	0.008		0.010		0.18	
1-24-83															

DATE	IRON DISS. (MG/L)	IRON TOTAL (MG/L)	LEAD DISS. (MG/L)	MAGNESIUM DISS. (MG/L)	MANGANESE DISS. (MG/L)	MERCURY DISS. (MG/L)	MOLYBDENUM DISS. (MG/L)	NICKEL DISS. (MG/L)	POTASSIUM DISS. (MG/L)	SELENIUM DISS. (MG/L)	SILICA as SiO_2 (MG/L)	SILVER DISS. (MG/L)	SODIUM DISS. (MG/L)	ZINC DISS. (MG/L)	VANADIUM DISS. (MG/L)	[illegible] Total	NITRATE + NITRITE (MG/L)	Sulfide	COMMENTS
9-16-82	0.032	98.000	<0.001	48.08	0.165	<0.0002	<0.001	0.010	4.90	<0.001			49.0	0.015		1.340		1.60	
10-15-82	1.020	2.150	<0.001	42.72	0.180	<0.0002	<0.001	<0.001	3.02	<0.001			35.0	0.016		1.310		0.84	
12-6-82	0.240	1.970	0.002	43.68	0.060	<0.0002	<0.001	<0.001	2.20	<0.001			14.5	0.035		0.090		<0.01	
1-24-83																			Snow

1-81

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

WATER QUALITY DATA

Station ____________
Location North Spring

DATE	TIME	FLOW CFS	TEMPERATURE AIR °C	TEMPERATURE WATER °C	pH	COLIFORM TOTAL MPN	COLIFORM FECAL MPN	FECAL STREP. MPN	C.O.D. MG/L	B.O.D. MG/L	T.O.C. MG/L	DISSOLVED OXYGEN MG/L	OIL & GREASE MG/L	PHENOL MG/L	NITROGEN AMMONIA as NH_3-N MG/L	NITROGEN NITRATE as NO_3-N MG/L	NITROGEN NITRITE as NO_2-N MG/L	NITROGEN TOTAL KJELDAHL MG/L	NITROGEN ORGANIC MG/L
9-14-82	11:00	0.58		7.0	7.0										0.38	0.33	0.02		
9-16-82	15:00		19	9	7.6										0.26	0.30	<0.01		
11-15-82	17:40	0.51	8	7	7.4	2.0	<2.0								0.46	0.29	0.02		
11-9-82	12:38	0.51																	
12-7-82	13:10	0.33	0	5	7.2										<0.01	0.13	0.03		
1-24-83	In-Accessible																		

DATE	PHOSPHATE TOTAL as PO_4-P MG/L	PHOSPHATE ORTHO as PO_4-P MG/L	SULFATE as SO_4 MG/L	HYDROXIDE as OH MG/L	SURFACTANT as MBAS MG/L	SOLIDS TSS MG/L	SOLIDS TOTAL SETTLEABLE SOLIDS ML/L	SOLIDS TDS MG/L	SOLIDS TOTAL SOLIDS MG/L	SOLIDS TOTAL VOLATILE SOLIDS MG/L	SPECIFIC COND µMHOS/CM	TURBIDITY NTU	CARBONATE ALK as CO_3 MG/L	BI-CARBONATE ALK as HCO_3 MG/L	TOTAL ALK as $CaCO_3$ MG/L	TOTAL HARDNESS as $CaCO_3$ MG/L	ALPHA RADIO-ACTIVITY pCi/L	BETA RADIO-ACTIVITY pCi/L	
9-14-82			6.0					452			582		<0.01	531.90		374			
9-16-82		0.030	15.0					450			652		<0.01	531.90		354			
11-15-82		0.020	36.0					433			760		<0.01	478.20		342			
11-9-82																			
12-7-82		0.099	51.0					362			471		<0.01	360.70		328			
1-24-83																			

DATE	ALUMINUM DISS MG/L	ANTIMONY DISS MG/L	ARSENIC DISS. MG/L	BARIUM DISS. MG/L	BERYLLIUM DISS. MG/L	BORON DISS. MG/L	CADMIUM DISS MG/L	CALCIUM DISS. MG/L	CHLORIDE DISS. MG/L	CHROMIUM HEX as CR MG/L	COBALT DISS. MG/L	COPPER DISS. MG/L	CYANIDE as CN MG/L	FLUORIDE DISS. MG/L	GERMANIUM DISS. MG/L
9-14-82								76.00	11.20					0.12	
9-16-82	0.008		<0.001	0.065		0.017	<0.001	73.60	8.10	<0.001		0.010		0.15	
11-15-82	<0.001		<0.001	0.060		0.020	<0.001	78.20	4.10	<0.001		0.011		0.13	
11-9-82															
12-7-82	<0.001		<0.001	0.055		0.030	<0.001	64.80	4.60	<0.001		0.011		0.15	
1-24-83															

DATE	IRON DISS. MG/L	IRON TOTAL MG/L	LEAD DISS. MG/L	MAGNESIUM DISS. MG/L	MANGANESE DISS. MG/L	MERCURY DISS MG/L	MOLYBDENUM DISS. MG/L	NICKEL DISS. MG/L	POTASSIUM DISS. MG/L	SELENIUM DISS. MG/L	SILICA as SiO_2 MG/L	SILVER DISS. MG/L	SODIUM DISS. MG/L	ZINC DISS. MG/L	VANADIUM DISS. MG/L	Manganese Total	NITRATE + NITRITE MG/L	Sulfide	COMMENTS
9-14-82		0.114		44.16					9.50				33.0			0.012		<0.01	Total metal data - See file
9-16-82	0.025	0.130	<0.001	40.80	0.020	<0.0002	<0.001	<0.001	6.70	<0.001			45.0	0.026		0.020		<0.01	
11-15-82	0.010	0.030	<0.001	38.40	0.024	<0.0002	<0.001	<0.001	1.79	<0.001			39.0	0.022		0.025		0.24	
11-9-82																			
12-7-82	0.210	0.200	<0.001	39.84	0.015	<0.0002	<0.001	<0.001	1.94	<0.001			13.5	0.022		0.630		<0.01	Light Snow
1-24-83																			Snow

1-81

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

WATER QUALITY DATA

Station ____________
Location South Spring

DATE	TIME	FLOW (CFS)	TEMPERATURE AIR (°C)	TEMPERATURE WATER (°C)	pH	COLIFORM TOTAL (MPN)	COLIFORM FECAL (MPN)	FECAL STREP. (MPN)	C.O.D. (MG/L)	B.O.D. (MG/L)	T.O.C. (MG/L)	DISSOLVED OXYGEN (MG/L)	OIL & GREASE (MG/L)	PHENOL (MG/L)
9-14-82	11:00	0.02		9	6.8									
9-16-82	15:05		19	12	7.1									
10-15-82	17:50	0.002	8	9	7.3	<2.0	<2.0							
11-9-82	13:04	0.003												
12-7-82	13:20	0.03	0	8	7.2									
1-29-83	Inaccessible													

DATE	NITROGEN AMMONIA as NH_3-N (MG/L)	NITROGEN NITRATE as NO_3-N (MG/L)	NITROGEN NITRITE as NO_2-N (MG/L)	NITROGEN TOTAL KJELDAHL (MG/L)	NITROGEN ORGANIC (MG/L)	PHOSPHATE TOTAL as PO_4-P (MG/L)	PHOSPHATE ORTHO as PO_4-P (MG/L)	SULFATE as SO_4 (MG/L)	HYDROXIDE as OH (MG/L)	SURFACTANT as MBAS (MG/L)	SOLIDS TSS (MG/L)	SOLIDS TOTAL SETTLEABLE SOLIDS (ML/L)	SOLIDS T.D.S. (MG/L)	SOLIDS TOTAL SOLIDS (MG/L)	SOLIDS TOTAL VOLATILE SOLIDS (MG/L)	SPECIFIC COND (µMHOS/CM)	TURBIDITY (NTU)	CARBONATE ALK. CO_3 (MG/L)	BI-CARBONATE ALK. as HCO_3 (MG/L)	TOTAL ALK as $CaCO_3$ (MG/L)	TOTAL HARDNESS as $CaCO_3$ (MG/L)	ALPHA RADIO-ACTIVITY (pCi/L)	BETA RADIO-ACTIVITY (pCi/L)
9-14-82																							
9-16-82	<0.01	0.25	0.05					42.0					510			658		<0.01	556.30		458		
10-15-82	0.16	0.20	<0.01				0.040	96.0					670			835		<0.01	666.10		516		
11-9-82	0.31	0.15	0.02				0.040	90.0					499			910		<0.01	479.60		450		
12-7-82	0.31	0.08	0.03				0.100	110					486			777		<0.01	408.20		430		
1-29-83																							

DATE	ALUMINUM DISS (MG/L)	ANTIMONY DISS. (MG/L)	ARSENIC DISS. (MG/L)	BARIUM DISS (MG/L)	BERYLLIUM DISS. (MG/L)	BORON DISS. (MG/L)	CADMIUM DISS (MG/L)	CALCIUM DISS (MG/L)	CHLORIDE DISS. (MG/L)	CHROMIUM HEX as CR (MG/L)	COBALT DISS (MG/L)	COPPER DISS. (MG/L)	CYANIDE as CN (MG/L)	FLUORIDE DISS. (MG/L)	GERMANIUM DISS. (MG/L)	IRON DISS. (MG/L)
9-14-82								95.20	7.80					0.12		
9-16-82	<0.001		<0.001	0.050		0.010	<0.001	98.40	8.40	<0.001		0.010		0.15		0.040
10-15-82	<0.001		<0.001	0.045		0.040	<0.001	93.60	4.60	<0.001		0.009		0.13		0.050
12-7-82	<0.001		<0.001	0.040		0.040	<0.001	90.40	11.20	<0.001		0.010		0.15		0.870
1-24-83																

DATE	IRON TOTAL (MG/L)	LEAD DISS. (MG/L)	MAGNESIUM DISS. (MG/L)	MANGANESE DISS. (MG/L)	MERCURY DISS. (MG/L)	MOLYBDENUM DISS. (MG/L)	NICKEL DISS. (MG/L)	POTASSIUM DISS. (MG/L)	SELENIUM DISS. (MG/L)	SILICA as SiO_2 (MG/L)	SILVER DISS. (MG/L)	SODIUM DISS. (MG/L)	ZINC DISS. (MG/L)	VANADIUM DISS. (MG/L)	Manganese Total	NITRATE + NITRITE (MG/L)	Sulfide	COMMENTS
9-14-82	0.105		52.80					4.70				22.0	0.014		0.011		<0.01	Total metal data - see file
9-16-82	0.400	<0.001	61.44	0.017	<0.0002	<0.001	<0.001	8.10	<0.001			64.0	0.020		0.020		0.80	
10-15-82	1.000	<0.001	51.84	0.019	<0.0002	<0.001	<0.001	3.06	<0.001			20.6	0.121		0.021		<0.01	
12-7-82	1.100	<0.001	48.96	0.020	<0.0002	<0.001	<0.001	2.99	<0.001			17.0	0.040		0.025		<0.01	
1-24-83																		Snow

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VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

WATER QUALITY DATA

Station ________
Location Side Canyon Spring

DATE	TIME	FLOW CFS	TEMPERATURE AIR °C	TEMPERATURE WATER °C	pH	COLIFORM TOTAL MPN	COLIFORM FECAL MPN	FECAL STREP MPN	COD MG/L	BOD MG/L	TOC MG/L	DISSOLVED OXYGEN MG/L	OIL & GREASE MG/L	PHENOL MG/L	NITROGEN AMMONIA as NH_3-N MG/L	NITROGEN NITRATE as NO_3-N MG/L	NITROGEN NITRITE as NO_2-N MG/L	NITROGEN TOTAL KJELDAHL MG/L	NITROGEN ORGANIC MG/L	PHOSPHATE TOTAL as PO_4-P MG/L	PHOSPHATE ORTHO as PO_4-P MG/L	SULFATE as SO_4 MG/L	HYDROXIDE as OH MG/L	SURFACTANT as MBAS MG/L	SOLIDS TSS MG/L	SOLIDS TOTAL SETTLEABLE SOLIDS ML/L	SOLIDS TDS MG/L	SOLIDS TOTAL SOLIDS MG/L	SOLIDS TOTAL VOLATILE SOLIDS MG/L	SPECIFIC COND µMHOS/CM	TURBIDITY NTU	CARBONATE ALK. CO_3 MG/L	BI-CARBONATE ALK as HCO_3 MG/L	TOTAL ALK as $CaCO_3$ MG/L	TOTAL HARDNESS as $CaCO_3$ MG/L	ALPHA RADIO-ACTIVITY pCi/L	BETA RADIO-ACTIVITY pCi/L
7-14-82	10:00	0.07	7	12	6.8										0.29	0.20	0.04					42.0					560			618		<0.01	613.2		454		
9-16-82	15:33		14	13	7.1										0.21	0.17	<0.01				0.040	78.0					670			797		<0.01	594.20		420		
10-15-82	16:25	0.06	10	12	7.3	<2.0	<2.0								0.03	0.08	0.04				0.020	86.0					505			864		<0.01	486.80		460		
11-9-82	12:30	0.07																																			
12-7-82	12:20	0.05	8	8	6.5										0.37	<0.01	0.02				0.012	122					515			863		<0.01	496.30		444		
1-24-83	InAccessible																																				

DATE	ALUMINUM DISS MG/L	ANTIMONY DISS. MG/L	ARSENIC DISS. MG/L	BARIUM DISS. MG/L	BERYLLIUM DISS. MG/L	BORON DISS. MG/L	CADMIUM DISS MG/L	CALCIUM DISS. MG/L	CHLORIDE DISS. MG/L	CHROMIUM HEX as CR MG/L	COBALT DISS. MG/L	COPPER DISS. MG/L	CYANIDE as Cn MG/L	FLUORIDE DISS. MG/L	GERMANIUM DISS. MG/L	IRON DISS. MG/L	IRON TOTAL MG/L
7-14-82								95.20	9.50					0.12			0.125
9-16-82	<0.001		<0.001	0.035		0.011	<0.001	83.20	7.60	<0.001		0.010		0.14		0.125	0.300
10-15-82	<0.001		<0.001	0.045		0.030	<0.001	94.40	3.90	<0.001		0.009		0.12		0.080	0.330
11-9-82																	
12-7-82	<0.001		<0.001	0.035		0.035	<0.001	88.00	12.00	<0.001		0.010		0.14		0.280	1.100
1-24-83																	

DATE	LEAD DISS. MG/L	MAGNESIUM DISS. MG/L	MANGANESE DISS. MG/L	MERCURY DISS. MG/L	MOLYBDENUM DISS. MG/L	NICKEL DISS. MG/L	POTASSIUM DISS. MG/L	SELENIUM DISS. MG/L	SILICA as SiO_2 MG/L	SILVER DISS. MG/L	SODIUM DISS. MG/L	ZINC DISS. MG/L	VANADIUM DISS. MG/L	Manganese Total	NITRATE + NITRITE MG/L	Sulfide	COMMENTS
7-14-82		51.84					7.10				45.0			0.015		<0.01	Total metal data - see file
9-16-82	<0.001	50.88	0.020	<0.0002	<0.001	<0.001	5.40	<0.001			106	0.020		0.020		0.80	
10-15-82	<0.001	53.16	0.020	<0.0002	<0.001	<0.001	3.11	<0.001			16.5	0.023		0.022		0.47	
11-9-82																	
12-7-82	0.002	53.76	0.024	<0.0002	<0.001	<0.001	3.13	<0.001			16.0	0.018		0.025		<0.01	
1-24-83																	Snow

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